

What is claimed is:

[Claim 1] 1. A patterning method, comprising:

providing a substrate having a film formed over thereon;
forming a photoresist layer over the film;
exposing and developing the photoresist layer to form a patterned photoresist layer; and
etching the film using the patterned photoresist layer as an etching mask at a temperature range of about -50°C to about 50°C.

[Claim 2] 2. The patterning method of claim 1, wherein the temperature range is between about -30°C and about 30°C.

[Claim 3] 3. The patterning method of claim 1, wherein the temperature range is controlled via a susceptor positioned below the substrate.

[Claim 4] 4. The patterning method of claim 1, wherein the etching process comprises an anisotropic plasma etching process.

[Claim 5] 5. The patterning method of claim 1, wherein the anisotropic plasma etching process is performed by directing an ionized plasma via a field.

[Claim 6] 6. The patterning method of claim 5, wherein the ionized plasma is formed by ionizing a plasma source comprising at least one inert gas selected from a group consisting of helium (He), neon (Ne), argon (Ar), krypton (Kr) and xenon (Xe).

[Claim 7] 7. The patterning method of claim 5, wherein a flow rate of the ionized plasma is in a range of about 20sccm to about 200sccm.

[Claim 8] 8. The patterning method of claim 6, wherein the plasma source further comprises an external plasma source.

[Claim 9] 9. The patterning method of claim 8, wherein the external plasma source comprises CF₄:CHF₃, CF₄:CH₂F₂, C₂F₆:CHF₃ or C₂F₆:CH₂F₂.

[Claim 10] 10. The patterning method of claim 9, wherein a gas flow ratio of CF₄ to CHF₃ of the CF₄:CHF₃, a gas flow ratio of CF₄ to CH₂F₂

of the $\text{CF}_4:\text{CH}_2\text{F}_2$, a gas flow ratio of C_2F_6 to CHF_3 of the $\text{C}_2\text{F}_6:\text{CHF}_3$, or a gas flow ratio of C_2F_6 to CHF_3 of the $\text{C}_2\text{F}_6:\text{CHF}_3$ is larger than 1.

- [Claim 11] 11. The patterning method of claim 5, wherein the field comprises an electric field or a magnetic field.
- [Claim 12] 12. The patterning method of claim 11, wherein a power applied at one electrode for generating the electric field is in a range of about 150W to about 300W.
- [Claim 13] 13. The patterning method of claim 1, wherein a thickness of the patterned photoresist layer is in a range of about 200nm to about 500nm.
- [Claim 14] 14. The patterning method of claim 1, wherein the photoresist layer comprises a positive photoresist layer or a negative photoresist layer.
- [Claim 15] 15. The patterning method of claim 1, wherein the film comprises a single layer or multiple layers.
- [Claim 16] 16. The patterning method of claim 1, wherein the film comprises a dielectric layer, an inter-metal dielectric (IMD) layer or an inter-layer dielectric (ILD) layer.
- [Claim 17] 17. The patterning method of claim 1, wherein the film comprises an oxide layer, a nitride layer, a poly-silicon layer or a single crystal silicon layer.
- [Claim 18] 18. The patterning method of claim 1, wherein the patterning method is performed to form a trench structure, a contact structure or a via structure in the film.
- [Claim 19] 19. The patterning method of claim 17, wherein the trench structure comprises a shallow trench isolation (STI) structure.